Successful Extraction of Low-Grade Ni–Co Ores from Ophiolite-Type Serpentinite by Chinese Experts

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Since the first discovery of the excellent performance of nickel-bearing iron alloys in 1889, scientists have developed 3000 more kinds of nickel alloys, which still have an enormous market demand at present. However, the scarcity of global nickel ore resources has restricted economic development. In recent years, experts from the Institute of Multipurpose Utilization of Mineral Resources have studied the comprehensive utilization technique of low-grade nickel ores from ophiolite in the Suyekebei nickel ore deposit, Tuoli county, Xinjiang, and have made great progress. They addressed the issue of comprehensive utilization of low-grade Ni–Co ores from serpentinite, and discovered a new source of such ores, greatly improving the security level of global nickel resources.

The Suyekebei nickel deposit is located in the Mayila–Tangbale ophiolite belt in west Junggar, Xinjiang. There are 40 more outcrops, including 10 more large ultramafic rockbodies, about 800–1870 m long and 88–200 m wide, covering an area of 0.18–0.45 km\textsuperscript{2}. Rocks are dominated by dunite, harzburgite and lherzolite, with chromite mineralization; they were altered to talc magnesite and serpentine after weathering. During 1962–1963, the Xinjiang Geological Bureau discovered unhomogeneous nickel (0.1%–0.3%) and cobalt (0.1%–0.3%) in the surface serpentine rocks. The recent detailed investigation confirmed that rocks from the Suyekebei ophiolite rockbodies contain 0.23% nickel and 0.012% cobalt, indicative of an ophiolite-type micro-fine disseminated low-grade Ni–Co-bearing deposit.

This type of Ni–Co deposit contains a low content of nickel, and useful nickel minerals are fine-grained disseminated; gangue minerals are principally layered serpentine, occupying 93.36% of the ore minerals; this makes it difficult to achieve ideal monomer dissociation. Because of the high content of serpentine and talc in the ores, and their ease to slime, pulp condensates formed by conventional wet milling adsorbed in the surface of the pulp, and can turn pasty. This leads to a poor grinding effect, with recovery of nickel ores only about 30%.

To address these difficulties, scientists adopted dry grinding and centrifugal de-sliming. The dry grinding technique solves self condensation of gangue minerals; the centrifugal de-sliming effectively de-slimes, with high mud recovery and low metal loss rate (nickel content in slime is only 0.051%). The de-slimed materials use twice roughing, one scavenging and twice-cleaning processes, and utilize hexametaphosphate, water glass, CMC, amyl xanthate and 2# oil flotation reagent to reach a nickel comprehensive recovery of 51.31% and a cobalt recovery of 51.06%; good beneficiation indexes of 0.22% nickel and 0.012% cobalt from raw ores and 9.51% nickel and 0.47% cobalt from concentrates were achieved. If the daily processing ores are 3000 t and the annual processing ores are 1 million ton, the yearly output value of nickel ore concentrates will total 133.37 million yuan. This area has yielded discoveries of the same type of ore reserves amounting to 0.107 billion tons, nickel metal resources reaching up to 0.225 million tons and cobalt metal resources up to 10700 tons. A rational development and utilization of these resources will surely make a considerable profit. The mining right owner plans to put all into large-scale production by 2020.

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